

# Size-Segregated Aerosol Composition and Mass Loading of Atmospheric Particles as Part of the Pacific Northwest 2001 (PNW2001) Air Quality Study in Puget Sound, WA

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# Size-segregated aerosol composition and mass loading of atmospheric particles as part of the Pacific Northwest 2001 (PNW2001) air quality study in Puget Sound, WA.

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## INTRODUCTION

Size and composition are key factors in determining the impact aerosols have on global climate change and human health. The DELTA group at UC Davis has developed sampling techniques that allow continuous collection of aerosols separated into 8 different size fractions with 1-hour time resolution.

**Total aerosol mass determination:** Scanning Transmission Ion Microscopy (STIM) with a 3 MeV proton beam can produce profiles of aerosol mass with an error limit of less than 10%. The aerosol collection strip is scanned with a proton beam of 50 micrometer spatial resolution while recording the proton mean energy loss as a function of position (Bench *et al.*, 1992). A differential beta attenuation mass monitor (beta-gauge) is also used for mass determination. The beta-gauge consists of a  $^{63}\text{Ni}$  source and a surface barrier detector. This technique allows quantitative mass measurement by recording attenuation of beta particles through the sample and substrate (Chueinta and Hopke, 2001).

**Mineral mass and elemental composition:** Synchrotron X-ray Fluorescence (s-XRF) is performed at the Advanced Light Source (ALS) at LBNL. The s-XRF technique is quantitative for elements Na through U. The ALS synchrotron provides an extraordinarily intense white beam of X-rays (4-20 KeV) that are 100% polarized. These properties provide us with a very high count rate and a reduced background, giving us exceptional sensitivity. Also, the beam can be focused to a spot on the order of 200 microns yielding time resolution on our sample strips of approximately 1 hour (Cahill *et al.*, 1992).

**Organic mass determination:** Proton Elastic Scattering Analysis (PESA) is performed at the Center for Accelerator Mass Spectrometry at the LLNL. PESA determines the concentration of particulate hydrogen, which is a surrogate for organic aerosol composition (Nejedly *et al.*, 1997).

**Organic compound determination:** Laser Desorption/Ionization Time-of-Flight Mass Spectrometry (LDI-TOFMS) is used to characterize polycyclic aromatic hydrocarbons (PAHs) and their derivatives in aerosols, as well as sulfates and nitrates. We use a low laser power in order to minimize fragmentation, and a wavelength which is resonant for PAH photo-ionization (Bezabeh *et al.*, 1999).

**Characterization of individual particles:** Scanning electron microscopy (SEM) coupled with a state-of-the-art field emission gun (FEG) is used to provide imaging with a resolution capability better than 2 nm (magnifications greater than 600 kX). Single particle analysis by SEM provides elemental composition, heterogeneity information, shape, size, and morphology of individual particles.

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